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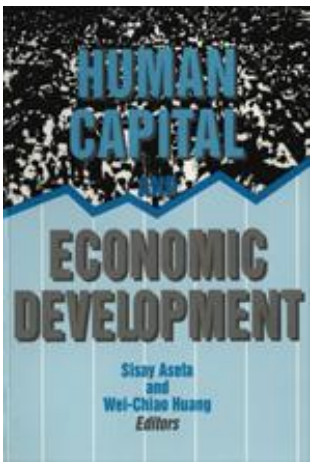


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# Workplace Training in the United States

## Is It Underproduced?

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Economists have long been interested in investigating the determinants and outcomes of investments in job training. Starting with the pathbreaking work by Jacob Mincer (1962), researchers have gone on to document how job training affects the careers of individuals through its impact on wage growth, turnover behavior, and unemployment experiences. Studies have also focused on the way in which job training improves the productivity of business organizations (Bartel, forthcoming; Holzer et al. 1993) as well as the competitiveness of nations (U.S. Congress 1990).

During the last few years, a perception has grown that American workers do not receive sufficient on-the-job training. Many have argued that government must take a more active role in the market for training. Indeed, much of the campaigning in the last presidential election focused on this issue. In this paper, I attempt to answer the question posed in the title. The plan of attack is as follows. I first review the data available from various sources on the amount of training that American workers receive and then analyze and compare workplace training in other countries to the American experience. The next section shows how data on rates of return to investments in job training can be used to determine if underinvestment exists, followed by analysis of the likely causes of underinvestment and evaluation of the various proposals that have been suggested as cures for the underinvestment problem. I then discuss my recent research on the relationship between technological change and training and show the implications of these research findings for the question posed in the title of this paper.

## What Do We Know About Workplace Training in the United States?

Our knowledge about the amount of workplace training in the United States is only as good as the quality of the available data on training. Two types of data sources can be consulted: surveys of individual workers and employer surveys. Training questions are included in the following surveys of individuals: the Current Population Survey, the Panel Study of Income Dynamics and the National Longitudinal Surveys of Mature Men, Young Men, Young Women, and Youth. The latter survey, the NLSY, is unique in the comprehensiveness of the training data reported. Data on a maximum of seven different training programs taken at any time since the last interview are included. Beginning with the 1988 survey, data on the following items are available for each of the seven training programs: when the respondent began and ended the training programs; what type of program it was, e.g., apprenticeships, company training, technical/vocational training off the job (such as business college, nurses programs, vocational and technical institutes, barber or beauty school, a correspondence course) and government training; and how many hours the respondent usually devoted per week to this program.[1] In the other surveys of individuals it is not possible to observe when the training actually took place or to measure the duration of the training.[2] Hence, the NLSY is the best employee-based source for measuring workplace training.

Table 1 provides some descriptive statistics from the NLSY. The table shows that in 1990, approximately 13 percent of the individuals in the sample received company training each year, and the duration of this training was 250 hours. The individuals in this sample are young, between the ages of 25 and 32 (in 1990), when most workplace training takes place. A comparable survey of older individuals would presumably find a much lower incidence of training. Table 1 also shows that education level is an important determinant of receipt of training. Only 7.4 percent of individuals with less than a high school education received company training, compared to 24.6 percent of college graduates. Individuals who work in large firms are more likely to receive company training compared to those in small firms; 21 percent of individuals employed by firms with at least 1,000 employees received

**Table 1. Incidence and Duration of Company Training by Education and Size of Firm, 1990 National Longitudinal Survey of Youth Aged 14–21 in 1979**

| | All education | | Education<12 | | Education=12 | | Education,13–15 | | Education 16+ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % trained | Mean hrs. if trained | % trained | Mean hrs. if trained | % trained | Mean hrs. if trained | % trained | Mean hrs. if trained | % trained | Mean hrs. if trained |
| All firms (N=4,311) | 13.4 | 251.13 | 7.4 | 198.15 | 10.3 | 269.53 | 18.0 | 225.13 | 24.6 | 257.00 |
| Large firms (N=1,470) | 20.9 | 259.12 | 11.1 | 177.32 | 15.3 | 279.33 | 24.4 | 211.35 | 35.6 | 300.51 |
| Small firms (N=2,841) | 9.5 | 225.78 | 6.2 | 209.96 | 7.7 | 259.94 | 13.7 | 241.77 | 16.2 | 183.92 |

NOTE: Large firms are defined as firms with at least 1,000 employees

training compared to 9.5 percent of individuals in smaller firms. The picture painted by the data in table 1 is that company training is relatively uncommon; only 13 percent of individuals in the prime training years receive it, and it is concentrated among the highly educated working in large firms.

The second source of data, employer surveys, also paints a similar picture of small amounts of training. Lakewood Publications, the publishers of *Training Magazine*, reported that, based on a survey of 2,400 businesses, the aggregate expenditure on formal training was $45 billion in calendar year 1989. Averaged across the employed workforce, this implies an expenditure of $385 per worker. An alternative benchmark is that this expenditure equals 1.8 percent of total compensation in the United States.[3]

A major disadvantage of employer-based surveys is the low response rates on questions relating to the cost of employee training. Several years ago, Columbia Business School conducted a survey of human resource management practices in American businesses (Delaney, Ichniowski, and Lewin 1989). One part of the survey dealt with employee training and development, and businesses were asked whether they had a formal training program, and, if so, the annual cost per employee. Only 40 percent of the businesses that had formal training programs reported their annual cost. The probability of reporting the cost data was unrelated to the size of the business, return-on-assets, industry, capital/labor ratio, or the length of time the training program had been in operation (Bartel 1991). The problem seems to be that many businesses are not sure what costs should be included and/or they are unable to readily locate a cost measure for their organization. Aggregate cost data on employee training may, therefore, be an unreliable measure of the existence of underinvestment.

Workers in the United States receive training from sources other than formal company training programs, but the extent of participation is low. In the NLSY, 4.2 percent of the individuals reported receiving training in 1990 from one of the following sources: a business college, a vocational or technical institute, a barber or beauty school, or a correspondence course. Apprenticeships in this sample of individuals were relatively rare. In 1990, only 1 percent of the individuals in the NLSY reported receiving training through an apprenticeship program. This finding is not atypical of other data sources on apprenticeships in the

United States. For example, the U.S. Congress (1990) reports that, between 1970 and 1987, apprentices in federally registered programs fell from 0.3 percent of the United States civilian workforce to only 0.16 percent.

Informal on-the-job training, on the other hand, appears to be quite important for American workers. In the January 1991 Current Population Survey (U.S. Department of Labor 1992), 38 percent of the individuals who reported receiving skill improvement training on their current job indicated that the source of that training was informal on-the-job training. Formal company training was reported as the source of skill improvement training for another 38 percent of the individuals. The remaining 24 percent reported school or miscellaneous sources. Hence, according to this survey, participation in informal on-the-job training occurs with the same frequency as participation in formal company training programs.

When training is measured by hours rather than by incidence, there is some evidence that informal on-the-job training is more important than formal company training programs. A 1989 Columbia Business School survey of two hundred businesses found that, during their first three months on the job, employees in these businesses spent three times as many hours in informal training as they did in formal training (Bartel 1991). Using data from the 1982 Employment Opportunity Pilot Project, Barron, Black, and Loewenstein (1989) also found that, during the first three months of employment, time spent in informal training exceeded time spent in formal training.

## How Does the United States Compare to Other Countries?

One way of judging whether workplace training is adequately provided in the United States is to compare the experience of a typical American worker with that of a worker living in another country. In this section, I describe the provision of training in Germany, France, and Japan and show how training in these countries differs from the United States.

### *Germany*

At age 16 or the completion of grade 10, German students select a "career track." Approximately 60 percent of the students choose to end their schooling at this point and enter an apprenticeship program. The remaining 40 percent go on to universities or to careers in skilled white-collar occupations that require attendance at vocational colleges. There are 380 officially recognized occupations for which apprentice positions exist (Dowling and Albrecht 1991). Eighty percent of all German firms with at least twenty employees participate in apprenticeship programs (U.S. Congress 1990).

The apprenticeship contract signed by the company and the apprentice states that the company must train the worker in subject areas that are determined by the regulations governing a particular occupation. The federal government works with trade associations and unions to define uniform national curricula and examinations. The contract sets out the length of the initial trial period of the apprentice (during which either party can opt out of the contract) and his or her wages. The apprenticeship period usually lasts between two and three years and is split equally between practical training in the firm and vocational education at a vocational school run by the government. At the end of the apprenticeship period, the student must pass a final exam consisting of theoretical and practical parts, which then certifies the student to pursue the occupation. Ninety percent of the apprentices are employed by the firm that trained them.

In sum, apprenticeships are a formalized part of the German training system. If apprenticeships were to serve as an indicator of the extent of job training, we would conclude that the American worker is undertrained relative to the German worker. But, as we have already indicated, training is multidimensional, and it is impossible to conclude, based on available data, that German workers do indeed receive more training overall than American workers.[4]

### *France*

Unlike the German system of training which relies on apprenticeships, the French system has as its central component a mandated training tax. Since July 1971, employers with ten or more employees

have been obligated to spend a certain percentage of their wage bill on continuing education and training of employees or pay a tax equal to the difference between the obligated and actual training expenditures. In 1971, this tax was 0.8 percent of the wage bill; as of January 1993, it is 1.4 percent. Unlike the situation in the United States, participation in formal company training is quite common in France. In 1990, 32 percent of all French employees received some formal company training (Bishop 1993). The incidence of training among young employees is likely to be higher than this number. Recall that in the United States, only 13 percent of individuals between the ages of 25 and 32 received formal company training in 1990. Although participation is much more extensive in France, formal training is of much shorter duration. In 1990, the average time spent in training by a trainee was only 46 hours! (The comparable figure for the United States is 250 hours.) There are some similarities between the American and French experiences. As in the United States, large French firms are more likely to provide formal training. In 1990, 53 percent of the employees in firms with at least 2,000 workers received training, compared to 8 percent of the employees in firms with 10–19 employees (Bishop 1993). There is also a positive relationship between skill level (education) and receipt of training. Whereas 50 percent of managers and professionals in French firms received formal company training in 1990, only 13 percent of unskilled operatives received it.

Hence, these data do not support the conclusion that French workers receive more training than American workers. While incidence of training is higher in France, duration is considerably smaller.

### *Japan*

The Japanese approach to training differs substantially from the German approach. In Japan, training is for a firm, not a trade. Large firms provide extensive workplace training, and there is minimal government involvement or assistance. The policy of providing continuous training for employees is largely grounded in the Japanese system of "lifetime employment" in large firms. A case study of American and Japanese autoworkers showed that autoworkers in Japanese plants receive three times as much training each year as workers in U.S. plants (U.S. Congress 1990).

While large firms in Japan provide extensive on-the-job training to their employees, only one-third of the Japanese labor force is employed by such firms. The remaining two-thirds work in small firms where lifetime employment is not guaranteed and training is not extensive.

## Rates of Return as Measures of Underinvestment in Training

As demonstrated above, a comparison of the U.S. training system with the systems used in other countries does not lead to an unambiguous conclusion that American workers are undertrained relative to their foreign counterparts. Here I approach the underinvestment question in a different way. In particular, I present data on the rates of return to job training for different groups of workers and consider whether the observed rates are too high. A rate of return above the rates on investments of comparable risk levels would enable us to conclude that underinvestment in job training does exist.

The rate of return that an employer earns on investment in employee training can be calculated by utilizing data on the costs of the training program and the returns that the employer receives. In order to calculate this accurately, the researcher would require information on the direct costs of the training program (i.e., instructors' salaries, materials, books, etc.), the time spent by trainees in the programs and the value of their lost productivity during the training period, and the increase in productivity that occurs after the training is completed and that can be attributed to participation in the training program. This is a very stringent list of requirements and can only be fulfilled if the researcher has access to a company that keeps good records and is willing to share the information.

I was fortunate to gain access to the personnel files and training database of a large manufacturing company. The direct costs of training were calculated from the company's records on the salaries of trainers, materials, and other expenses such as room and board for residential training programs. Indirect costs were calculated by multiplying the number of days spent in training by the daily salary earned by

the employee prior to participation in the training program. The returns that the company earned from the training program were calculated from a fixed effects model which estimated the effect of time spent in the training program on salary (Bartel 1992).[5] If workers are assumed to stay "forever" in this company, the rate of return equals the ratio of the annual return to training divided by the sum of the direct and indirect costs of training. Table 2 shows that the calculated rate of return on training for this company is 21 percent. Of course, it is unrealistic to assume that workers stay forever at a company, and the rate of return needs to be adjusted to reflect the expected tenure at the company.[6] In this company, expected tenure is about ten years, and the adjusted rate of return equals 17 percent.

**Table 2. Rates of Return on Investments in Job Training**

| Sample | Assuming "lifetime employment" (percent) | Assuming "average" tenure[a] (percent) |
|---|---|---|
| National Longitudinal Survey of Youth | 32 | 16 |
| Panel Study of Income Dynamics[b] | 29 | 25 |
| Large manufacturing company[c] | 21 | 17 |

a In this column, the rate of return is calculated by assuming that the payoff period for the investment equals the observed average length of tenure in the particular sample.
b. Mincer (1991).
c. Bartel (1992).

Admittedly these rates of return only pertain to one company and may not be generalizable to other companies in the United States. A more general estimate of the rate of return to job training in the United States can be calculated from national datasets on individuals. Unfortunately, with these datasets the cost of training may not be precisely measured. Information on direct costs of training are, of necessity, unavailable in datasets on individuals. The indirect costs of training can be inferred from data on the average amount of time spent in training by individuals who reported receiving training during the last year. Table 2 shows that in the NLSY sample, the calculated rate of return is

32 percent if the individuals are assumed to stay with their employers "forever," but that the rate of return falls to 16 percent when it is adjusted for expected tenure. Since the individuals in this sample are young, their expected tenure is only three years; this produces a large drop in the adjusted rate of return. Mincer (1991) calculated the rates of return on training for the individuals in the Panel Study of Income Dynamics, and I report those rates as well in table 2. The unadjusted rate is 29 percent and the adjusted rate is 25 percent.

The adjusted rates in table 2 range from 16 percent to 25 percent. These rates seem high when compared to other investments. For example, Bound and Johnson (1992) calculate that the private rate of return on a year of schooling is currently about 8.5 percent in the United States.[7] Using this number as a benchmark would lead to a conclusion that there is underinvestment in job training. It is possible, however, that the estimated rates of return on training may be overestimates of the true rates. This could occur if the true cost of training is underestimated or the returns on training are overestimated because of incomplete controls for unobserved heterogeneity or overly optimistic estimates of a worker's expected tenure.

## What Can Account for Underinvestment in Training?

If we use the rates of return reported in the previous section as evidence that workplace training in the United States is underproduced, we next need to consider why this underinvestment takes place. Armed with this analysis, we can then proceed to make informed policy recommendations to increase investment in training.

It has been argued (Bishop 1991) that American workers receive less training than their German and Japanese counterparts because the turnover rate is higher in the United States. The OECD (1984) reports that, for employees with less than one year of tenure, the probability of staying at the firm for at least twelve additional months is over 80 percent in the United Kingdom, 76 percent in Japan but only 41 percent in the United States. In Germany, 95 percent of apprentices who complete the three-month probationary period stay with their employer for the full three-year apprenticeship period (Bishop 1991). The typical pat-

tern of a young American worker is to engage in job shopping during the early years in the labor market. High rates of turnover will reduce the firm's incentive to invest in specific training. Bishop (1991) shows that employers also pay part of the costs of general training, and the expectation of high turnover will therefore also reduce the firm's incentive to provide general training.

Another factor contributing to less training in the United States is the difficulty that American employers have in assessing the quality of an applicant's general skills. In Germany, standardized curricula and national certification standards provide employers with reliable information on a job applicant's skills. In the United States, employers do not give enough weight to an applicant's stock of general skills. The result is that American workers have less incentive to invest in general skills.

The constraint imposed by the minimum wage reduces the incentive for firms to invest in training workers whose value of marginal product is less than the legislated minimum wage. This happens because the workers are unable to offer to pay for general training by accepting a wage below the minimum wage. Leighton and Mincer (1981) provide evidence that the minimum wage leads to less on-the-job training for low-skilled young workers than would otherwise occur. While it is true that employers are now able to pay a subminimum training wage to employees under the age of 20 for the first six months of their employment, this does not address the problem faced by unskilled workers aged 20 and over.[8]

A fourth reason for underinvestment is that young workers are unable to pay for the general skills that they need because they are liquidity-constrained. Since firms have no incentive to pay for general training (except, perhaps, because of the positive effect on their reputations), young workers must subsidize their own training and often have insufficient funds to do so.

Finally, it has been argued (U.S. Congress 1990) that American workers may receive less training than German and Japanese workers because they have poor basic skills. According to the Office of Technology Assessment, American companies find that, in their operations in Germany or Japan, workers have better reading and math skills than Americans in the United States. The absence of good basic skills

makes the American worker less trainable, thereby reducing the perceived return on the company's investment in training.

## Policy Options to Increase Investment in Training

In this section I review and evaluate a number of policy recommendations that have been suggested to increase employee and employer investments in on-the-job training. The first idea is that training should be provided by the government. The obvious criticism of this proposal is that the government will not have adequate information to know what types of skills businesses need in their employees.

A second approach is to adopt the French system whereby a payroll-based national training tax is imposed on all employers. Under this system, employers would either spend the mandated percentage amount on training or pay a tax equal to the difference between the obligated and actual training expenditures. While this approach is preferable to direct provision of training by the government because it allows the firm to decide on the amount and type of training, it suffers from a number of problems. First, there is no incentive for firms to spend beyond the mandated level. Second, it favors large firms because of economies of scale in the provision of formal training. Third, it completely ignores informal training, and we have already seen that informal training is a significant component of total training. Firms that find it optimal to rely on informal training would be penalized under this system. Fourth, there would be significant measurement problems as firms and the government debate what types of activities qualify as training.

A third approach is for the federal government to provide subsidies to firms that engage in training. This is more appealing than the mandate approach because it does not require firms to spend a stipulated amount; firms would enjoy more flexibility in making the optimal choice. The federal government's Job Training Partnership Act created a system to share the costs of training new employees with private firms. Unfortunately, recent reports (*Business Week* 1992) have documented misuse of JTPA funds. In particular, firms have been accused of using JTPA funds to cover the costs of "training" workers who were

already trained, as well as unreasonably extending the length of a worker's training period.

A number of states have training subsidy programs, and the evidence regarding the impact of these programs is, unlike the JTPA, generally positive. Creticos and Sheets (1990) studied the programs that exist in New York, Illinois, California, and Missouri and found that in twenty-four companies that received financial aid from the states, all of the companies showed improvements in business performance from the training. Holzer et al. (1993) have studied the training grant program operated in Michigan during 1988 and 1989, called the Michigan Job Opportunity Bank-Upgrade Program. They found that firms that received training grants significantly increased the amount of training they provided their employees; in other words, the subsidies did not simply provide windfalls to those firms already engaging in training. But the experiences with JTPA indicate that a government subsidy program will require careful monitoring to avoid abuse.

Another idea that has been suggested is that the government should subsidize the creation of employer training collectives (U.S. Congress 1990). The purpose of these collectives would be for firms in an industry to jointly provide the skills necessary for that industry. By sharing the costs and risks of providing training, firms would have an incentive to train more. The disadvantage of this approach is that firms in an industry may be concerned about sharing proprietary information. Also, free-riders outside the consortia could attempt to raid the newly trained workers.

Finally, there are some government programs that can be introduced to increase the incentive for the employee to invest in general training. Like the German government, the U.S. government can work with industry and trade groups to establish national certification standards for various trades and occupations. This will enable employers to assess the quality of the general skills an applicant possesses. In addition, the federal government could consider providing low-cost loans to individuals who wish to acquire general skills. Alternatively, a revision of the current tax law that pertains to the deductibility of an employee's own training expenses could be considered. At the present time, if an employee pays for his or her own training, the expenses can only be deducted if the sum of those expenses plus all other miscella-

neous deductions exceeds 2 percent of an individual's adjusted gross income.

## The Role of Technological Change

The programs discussed in the previous section are attempts to address perceived flaws in the U.S. market for training. Each of the suggested programs strives to increase training by either circumventing the market entirely, subsidizing the costs incurred by trainees or trainers, or improving the quality of information in the labor market.

It is possible, however, that the future for the U.S. training market is brighter than we currently think. The ratio of expenditures on company-sponsored R&D to net sales has been increasing in the United States in recent years (National Science Foundation 1989). Rates of productivity growth in the 1980s are far ahead of the rates observed in the late 1970s (U.S. Department of Labor 1992). All of this bodes well for the training of American workers because, in a world in which firms are updating or changing their production technologies, the opportunities for learning expand. When firms are introducing new technologies, they have an incentive to train their employees in order to reap the productivity gains from the technological change. A formal way of stating this argument is that the marginal cost of producing a unit of human capital investment decreases with technological change (Tan 1989).

Some people may take a more pessimistic view of the relationship between technological change and training. The basis for the pessimistic view is that technological change increases the rate at which human capital depreciates. Within the Ben-Porath (1967) framework, higher rates of depreciation reduce the marginal return to investment and thereby lead to less investment in on-the-job training in each time period. The theoretical prediction about the impact of technological change on the amount of on-the-job training is ambiguous.

In my paper with Nachum Sicherman (Bartel and Sicherman 1993), I conducted an empirical analysis that resolves the theoretical ambiguity. We used the 1979–1990 National Longitudinal Surveys of Labor Market Experience of Youth aged 14–21 in 1979 to analyze whether

individuals who work in industries that are technologically progressive receive more training, *ceteris paribus*. Since our study covers both the manufacturing and nonmanufacturing sectors, we measure an industry's rate of technological change by its rate of productivity change as calculated by Jorgenson, Gollop, and Fraumeni (1987). Ideally, one would prefer to use R&D intensity as the measure of technological change in the industry, but R&D data are only available for the manufacturing sector. Griliches and Lichtenberg (1984) have shown that for the time period 1959–1976 there was a significant relationship between an industry's intensity of private R&D expenditures and subsequent growth in productivity. Lichtenberg and Siegel (1991) also found that this relationship existed at the company level in the 1970s and 1980s.

In our study, we estimated an equation in which the dependent variable is the probability of receiving company training since the last survey (i.e., during the last year) and the independent variables are (1) the mean rate of technological change in the individual's industry during the ten years prior to the date of the interview, and (2) a vector of control variables that includes education, experience and its square, tenure and its square, size of plant in which the individual works, marital status, race, union membership, and residence in an SMSA. We found that, in industries with higher rates of technological change, employees are significantly more likely to receive company training.

If rates of technological change continue to increase over the next decade as they have during the last five years, these findings would predict an increase in the amount of training that U.S. workers will receive. This will not require tampering with the U.S. training market by imposing targets for training, nor will it require an expenditure of government funds to subsidize the cost of training. Rather, an increase in employee training will be a simple by-product of increased rates of technological change and expenditures on R&D.

## Summary and Conclusions

I began this paper by posing the question of whether or not workplace training in the United States is underproduced. In order to answer this question, it was necessary to carefully review the data available on

the extent of workplace training in the United States. Since company data are generally sparse, researchers must rely on surveys of individuals that include questions on workplace training. These data show that only 13 percent of individuals in the prime training years (ages 25–32) received formal company training in the United States in 1990, and that this training was concentrated among the highly educated working in large firms. Apprenticeships are rare in the United States. Informal on-the-job training appears to be at least as important as formal company training.

The training experience of the American worker is very different from that of workers in other countries. But, specific comparisons with Germany, France, and Japan do not enable us to unambiguously conclude that American workers, in general, receive less training than their counterparts in those countries. An alternative approach to the underinvestment question is to consider whether the observed rates of return on investments in job training are too high. We found that rates are indeed high when compared to rates of return to education in the United States. Underinvestment in job training could be due to high turnover, the absence of standardized curricula and national certification standards for occupations, minimum wage constraints, liquidity constraints, and/or weak basic skills of American workers. Each of these causes suggests a proposed solution, and we reviewed and critiqued a number of these: (1) direct provision of training by the government, (2) a payroll-based national training tax similar to the system used in France, (3) government subsidies to firms that train their workers, (4) employer training collectives, and (5) low-cost loans and tax breaks for individuals who pay for their own training.

While the high rates of return to training may be consistent with a yes answer to the question posed in the title, I ended with an optimistic forecast for the future of the training market. Research evidence has shown that technological change increases the incentives for investment in training. If the recent upward trends in R&D expenditures and productivity growth rates in the U.S. continue, we can predict that opportunities for training will increase. The attractiveness of this scenario is that the increase in training will not require government interference with the training market.

# NOTES

1. Prior to 1988, detailed information on type of private sector training, as well as the weeks and hours per week spent in training, were only recorded if the training spell lasted at least four weeks

2. In the National Longitudinal Surveys of Young and Older Men and Young Women, the survey asks, "What was the longest type of training you have had since the last interview?" In the Current Population Survey, the question is, "What training was needed to get the current or last job and what training is needed to improve skills on the current job?"

3 In France, expenditures on formal company training equal 3 percent of total compensation.

4. In the report prepared by the U S Congress (1990), evidence is presented that workers in German metalworking firms receive more training than comparable workers in British metalworking firms. No evidence is presented, however, that beyond the apprenticeship period, German workers receive more training than American workers

5 The profitability of training is actually the increase in productivity less the increase in wages. Barron, Black, and Loewenstein (1989) and Blakemore and Hoffman (1988) show that productivity doubles compared to wages in the datasets that they analyze. This implies that the wage increase attributable to training is a good proxy for the productivity increase produced by training

6 Mincer (1991) shows that adjusted rate of return is calculated by the following formula $r = r^1(1 - (1/1+r)^T)$ where $T$ = expected tenure and $r$ is the adjusted rate of return

7 This does not include the consumption returns to schooling If these were added in, the rate of return on schooling would increase, and may approach the rate of return on training

8. In an analysis of the fast food industry, Katz and Krueger (1992) provide evidence that the subminimum training wage is rarely used

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